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References

BirdLife International (2001) *Threatened birds of Asia: the BirdLife International Red Data Book*. Cambridge, U.K.: BirdLife International.

BirdLife International (2011) Species factsheet: *Synthliboramphus wumizusume*, Available at: http://www.birdlife.org/datazone/speciesfactsheet.php?id=3314.

Carter, H. R., Ono, K., Fries, J. N., Hasegawa, H., Ueta, M., Higuchi, H., Moyer, J. T., Ochikubo Chan, L. K., de Forest, L. N., Hasegawa, M. & van Vliet, G. B. (2002) Status and conservation of the Japanese Murrelet (*Synthliboramphus wumizusume*) in the Izu Islands, Japan. *J. Yamashina Inst. Orn.* 33:61–87.

del Hoyo, J., Elliott, A. & Sargatal, J. (1996) *Handbook of the birds of the world*, 3. Barcelona: Lynx Edicions.

Harrison, P. (1983) *Seabirds: an identification guide*. Revised edition. Australia: Croom Helm.

IUCN (2011) *IUCN Red List of threatened species*. Version 2011.1. <www.iucnredlist.org>. Downloaded on 20 June 2011.

Kim, Eun-Mi, Park, Chan-Ryul & Kang, Chang-Wan (2010) The status on the legally protected birds of Korea in Jeju Island for the last three years. *Korean J. Orn.* 17: 259–273. (In Korean with English abstract.)

Kim, Hwa-Jung (2006) *Cheonyeonginyeommul Je Sambaeksasipilho Guguldo Haejoryu (Bbulsoe-ori, Badajebi, Seumsae) Beonsikji Monitoring Bogoseo (2006 nyeon)* [Monitoring for the seabirds' breeding (the Japanese Murrelet, the Swinhoe's Storm Petrel, and the Streaked Shearwater) in Gugul Island, National Monument no.341 (2006)]. Pp.5–22 in *The 2006 Cheonyeonginyeommul Monitoring* [Monitoring of National Monument]. Cultural Heritage Administration of Korea. (In Korean.)

Kim, Wan-Byung (2008) Avifauna of Mara Island, Korea. *J. Korean Nature* 1:143–148.

Kim, Wan-Byung, Kim, Young-Ho & Oh, Hong-Shik (2011) A study about checklist research of the birds of Jeju Island. *Korean J. Orn.* 18: 93–113. (In Korean with English abstract.)

Kwon, Young-Soo & Yoo, Jeong-Chil (2005) Breeding record of the Crested Murrelet (*Synthliboramphus wumizusume*) at Dokdo Island. *Korean J. Orn.* 12: 83–86. (In Korean with English abstract.)

Kyunghyang Shinmun (1983) *Jeonnam Gugulseomseo Huigwijo Bbulsoe-ori Balgyeon* [The observation of rare bird, the Japanese Murrelet, at Guguldo Island]. 3 June 1983. <http://dna.naver.com/viewer/index.nhn?editNo=2&printCount=1&publishDate=1983-01-01&officeId=00032&pageNo=1&printNo=11465&publishType=00020&articleId=19830101003292010O5&doNotReadAnyMore=notClose>. Downloaded on 27 July 2011. (In Korean.)

Lee, Kyung-Gyu, Ko, Kyung-Nam, Jegal, Gil-Myung & Park, Chun-An (2010) *A survey report on avifauna, shorebirds and seabirds of Shinan, 1004 Islands*. Shinan County. South Korea. (In Korean.)

Oh, Hong-Shik (2004) A study on the management of migratory bird sanctuary and the status of waterbird migration on Jeju Island. *Korean J. Orn.* 11: 11–32. (In Korean with English abstract.)

Park, Jin-Young (2002) Current status and distribution of birds in Korea. Ph.D. thesis, Kyung-Hee University, Seoul, South Korea. (In Korean.)

Won, Pyong-Oh (1992) *Yeorumcheolsae Doraeji, Beonsikji mit Haejoryu Beonsikji Haksuljosa Bogoseo* [Survey report of the breeding sites for seabirds and other summer visitors in Korea]. Korea Institute of Ornithology, Kyung-Hee University. (In Korean.)

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An intraspecific adult killing in female Japanese Great Tits *Parus major minor*

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Introduction

Intraspecific killing has been documented in a wide variety of avian taxa. Adults sometimes kill eggs and chicks of conspecifics when birds are competing for nesting sites (Belles-Isles & Picman 1986, Stanback & Koenig 1992, Inoue *et al.* 2010) or when birds are expanding their territories (Lee *et al.* 2011). Parents may also practise infanticide in cases of intraspecific brood parasitism when they identify parasitic chicks (Shizuka & Lyon 2010). In species that practise obligate brood reduction, the death of the victim is normally caused by a sustained assault by an older nestling and its evolution is concentrated in four orders: Gruiformes, Pelecaniformes, Accipitriformes and Sphenisciformes (Mock & Parker 1997, Simmons 2002).

Fighting among adults is also common, but there are few instances where birds have been observed to fight to the death, especially in small passerines. Direct observations of intraspecific killing between adults suggest that it can occur to provide food (i.e. cannibalism, Anderson 2004) or in response to nest-site competition (Flux & Flux 1992). However, the scarcity of reports means that there is a need for more observations of fighting between adults which result in death of one individual. This would lead to greater understanding of the conditions under which such events occur. In this paper, we report a case of intraspecific killing in Japanese Great Tits *Parus major minor*, providing a direct observation in which an adult female attacked and killed another adult female.

Observations

Our observation was made on a street beside a building at Rikkyo University, Toshima, Tokyo, Japan (35°44'N 139°42'E). Although the university campus is located in an urban area it has some open grounds with tall trees. Great Tits inhabit the campus year-round and nest in tree cavities from April to July.

We saw a Great Tit lying on the ground flapping its wings at 11h10 (Japan Standard Time) on 16 March 2010. Immediately, another Great Tit approached, swooped on, pushed and shoved the lying tit. The aggressor stuck its beak into the eyes of the other bird and plucked feathers from its back and abdomen. The

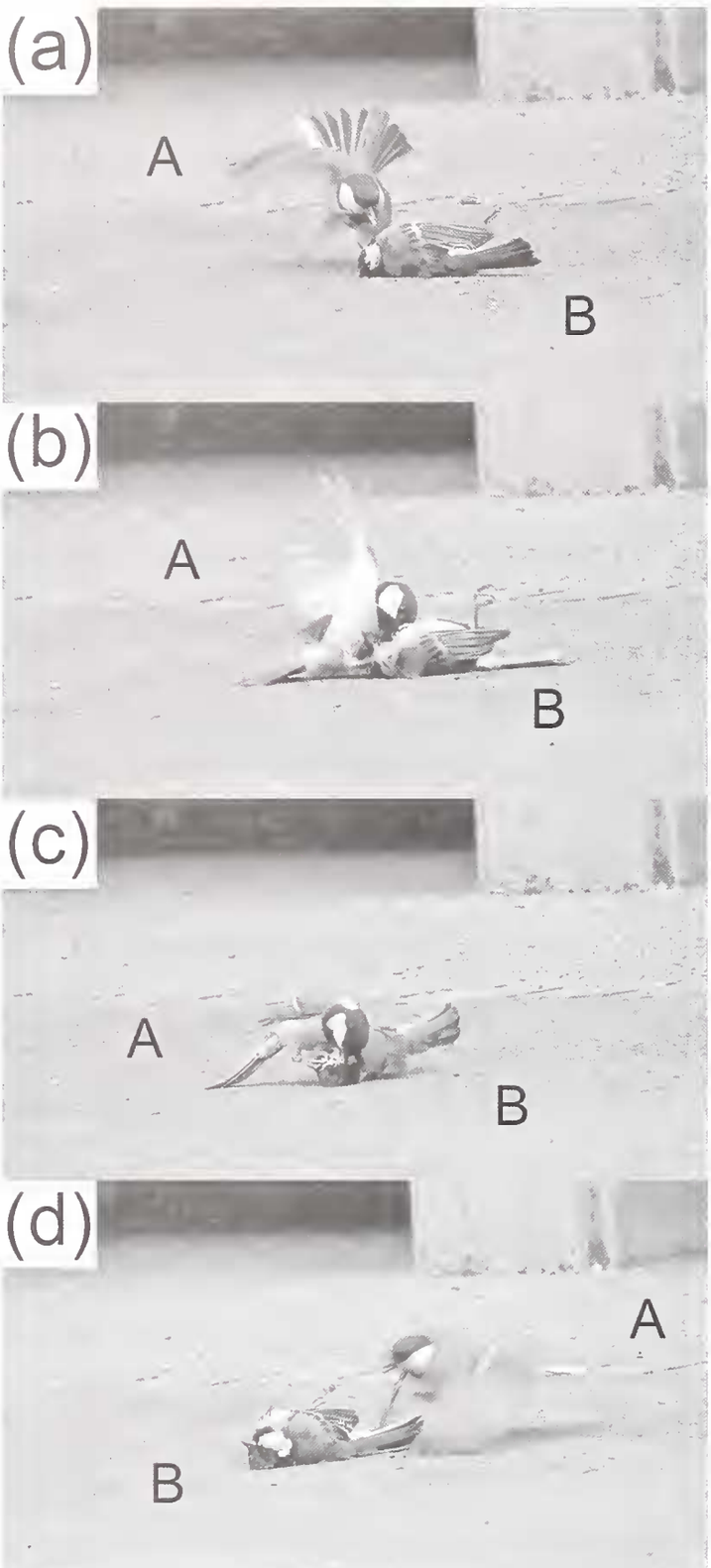

Figure 1. Video frames of a female Great Tit (A) attacking another conspecific female (B). (a) The aggressor flew towards the victim, (b) pressed it and pecked its abdomen, (c) stabbed its eye and (d) continued to attack the victim.

aggressor then returned to a perch near the victim and gave warning calls for a few minutes. It then flew back down to the victim and continued its attack. We observed six assaults with physical contacts over approximately 20 minutes. We recorded the last assault with a HDR-XR500 video camera (Sony Corporation, Tokyo, Japan) (Figure 1; clip available on website of Movie Archives of Animal Behavior, data number: momo120606pm01b, URL: http://zoo2.zool.kyoto-u.ac.jp/ethol/mov/12/1206/momo120606pm01.MP4). Both birds were adult females since female Great Tits have narrower and more obscure black mid-line stripes from the bib to vent than do males.

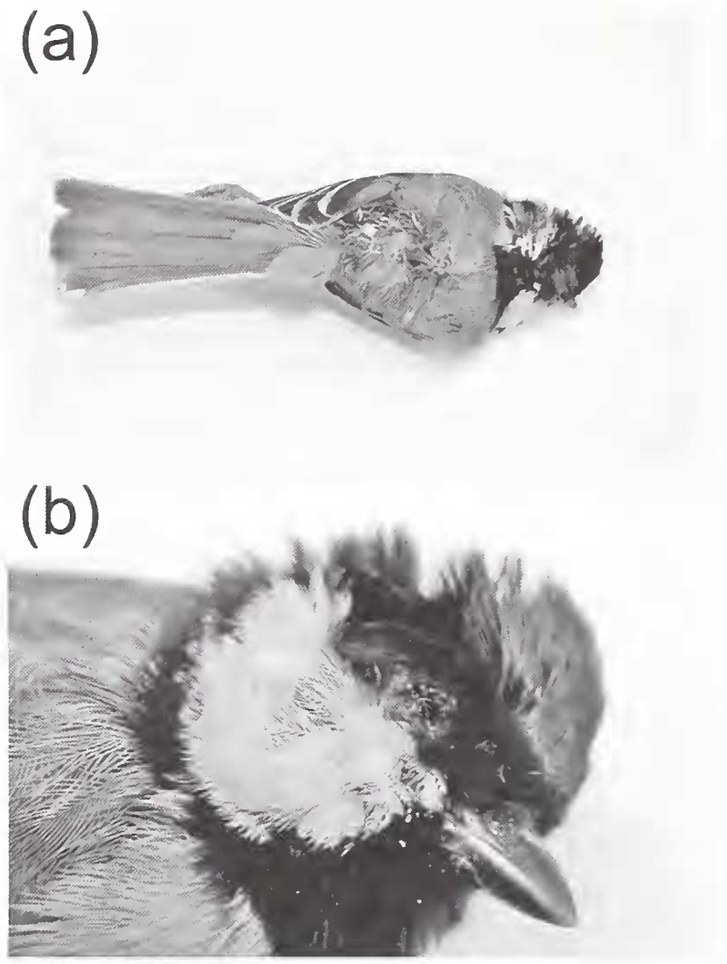

Figure 2. Marks of attacks by a female Great Tit on the dead body of a conspecific female. (a) Some feathers on the back were pulled out. (b) An eye was injured.

We waited until the aggressor had stopped its attacks and left the vicinity. We confirmed the death of the victim and collected its body. We dissected the dead bird for further inspection of its injuries and body condition. The dead tit had developed ovarian follicles (1.3 × 1.3 mm) and weighed 12.2 g, which is lighter than would be expected for an adult female (mean ± SE: 15.0 ± 0.8 g, N = 95: Ohori 2007). Feathers of the bird had been plucked from its neck, back and abdomen, and both its eyeballs had been ruptured (Figure 2). However, there were no wounds (such as holes in the flesh) that would suggest cannibalism.

Discussion

Since we did not see the beginning of the fight between the females, it is difficult to know why one of the tits was lying on the ground and killed by the other tit. However, the body mass of the victim was lighter than the average body mass of female Great Tits. Therefore, it is possible that the victim was in a poor body condition when it was fighting and less able to defend itself from attacks. It is also possible that the victim had been injured as a result of an accident (such as flying into a window) before being attacked. The attacking tit might have seen the victim lying on a street as it passed by and decided to attack. The black stripe on the breast of the Great Tit has been shown to be a releasing signal for aggressiveness in this species (Järvi & Bakken 1984). Scriba & Goymann (2008) also showed that stuffed mounts induced more extreme stress responses from European Robins *Erithacus rubecula* than did caged live birds. Therefore, the victim lying on the ground with its breast-stripe showing might have served to produce the extreme response of the attacker we report above.

Previous studies suggest that limited availability of desirable nest-sites causes aggressive interactions between females (e.g.

Rosvall 2008). Such competition might occasionally result in intraspecific killing. For example, in a New Zealand population of European Starlings *Sturnus vulgaris* females competed with one another intensely for access to nest-boxes. This competition occasionally resulted in one female stabbing the other with their claws, which could result in fatal injuries (Flux & Flux 1992). In a Belgian population of European Starlings with higher nest-box densities (and therefore less competition for nest-sites), females were less likely to fight for access to nest-boxes (Pinxten *et al.* 1989). Female European Starlings respond most aggressively towards other female starlings in the pre-laying phase of the breeding season, when competition is most intense for nest-sites (Sandell & Smith 1996). In the long-term study of Great Tits at Wytham Woods, dead bodies of females have been found early in the breeding season with their heads pecked (A. Gosler *in litt.* 2012). The attack we report here took place in early spring, when Great Tits are starting to breed and searching for suitable nest cavities. Therefore, female–female competition for nest-sites is another possible cause for the fight between the females.

The sustained nature of the attack is interesting as the attacking female continued to attack the prone bird for over 20 minutes. Cases of physical aggression in small passerines (including Great Tits) are normally much shorter than the length of time that we observed this fight (CAB pers. obs.). This is because fighting, whilst sometimes necessary to defend resources or offspring, is costly even for victors. There are direct energetic costs associated with fighting and as well as risks of injury (e.g. Haley 1994). Additionally, individuals may be subject to increased predation risk whilst they are engaged in fighting because they may not be so vigilant for predators and/or more conspicuous (e.g. Jacobsson *et al.* 1995). Finally, there may be opportunity costs in fighting such as lost foraging opportunities (e.g. Neat *et al.* 1998). Therefore, it would seem that this prolonged attack may not have been in the best interest of even the attacking female and might have been induced as a result of the behaviour and posture of the dying victim.

Our observations provide the first evidence of intraspecific killing between female Great Tits. There are some reports of intraspecific adult killing in other species (e.g. Lombardo 1986, Flux & Flux 1992, Anderson 2004). However, most observations are unlikely to be published. Therefore, we would encourage the publication of further observations of intraspecific killing in order to better understand the conditions that lead to escalation of fighting and to the death of one individual.

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References

Anderson, E. M. (2004) Intraspecific predation among Northwestern Crows. *Wilson Bull.* 116: 180–181.

Belles-Isles, J.-C. & Picman, J. (1986) House Wren nest-destroying behavior. *Condor* 88: 190–193.

Flux, J. E. C. & Flux, M. M. (1992) Nature red in claw: how and why starlings kill each other. *Notornis* 39: 293–300.

Haley, M. P. (1994) Resource-holding power asymmetries, the prior residence effect, and reproductive payoffs in male northern elephant seal fights. *Behav. Ecol. Sociobiol.* 34: 427–434.

Inoue, Y., Yoda, K., Fujii, H., Kuroki, H. & Niizuma, Y. (2010) Nest intrusion and infanticidal attack on nestlings in Great Cormorants *Phalacrocorax carbo*: why do adults attack conspecific chicks? *J. Ethol.* 28: 221–230.

Jacobsson, S., Brick, O. & Kullberg, C. (1995) Escalated fighting behaviour incurs increased predation risk. *Anim. Behav.* 49: 235–239.

Järvi, T. & Bakken, M. (1984) The function of the variation in the breast stripe of the Great Tit (*Parus major*). *Anim. Behav.* 32: 590–596.

Lee, S., Seo, K., Lee, W., Kim, W., Choe, J. C. & Jablonski, P. (2011) Non-parental infanticide in a dense population of the Black-billed Magpie (*Pica pica*). *J. Ethol.* 29: 401–407.

Lombardo, M. P. (1986) A possible case of adult intraspecific killing in the Tree Swallow. *Condor* 88: 112.

Mock, D. W. & Parker, G. A. (1997) *The evolution of sibling rivalry.* Oxford: Oxford University Press.

Neat, F. C., Taylor, A. C. & Huntingford, F. A. (1998) Proximate costs of fighting in male cichlid fish: the role of injuries and energy metabolism. *Anim. Behav.* 55: 875–882.

Ohori, S. (2007) Shijyuukara. *Bird Res. News* 4: 2–3. (In Japanese.)

Pinxten, R., Eens, M. & Verheyen, R. F. (1989) Polygyny in the European Starling. *Behaviour* 111: 234–256.

Rosvall, K. A. (2008) Sexual selection on aggressiveness in females: evidence from an experimental test with Tree Swallows. *Anim. Behav.* 75: 1603–1610.

Sandell, M. I. & Smith H. G. (1996) Female aggression in the European Starling during the breeding season. *Anim. Behav.* 53: 13–23.

Scriba, M. F. & Goymann, W. (2008) The decoy matters! Behavioural and hormonal differences in the reactions of European Robins towards stuffed and live decoys. *Gen. Comp. Endochrinol.* 155: 511–516.

Shizuka, D. & Lyon, B. E. (2010) Coots use hatch order to learn to recognize and reject conspecific brood parasitic chicks. *Nature* 463: 223–226.

Simmons, R. E. (2002) Siblicide provides food benefits for raptor chicks: re-evaluating brood manipulation studies. *Anim. Behav.* 64: F19–F24.

Stanback, M. T. & Koenig, W. D. (1992) Cannibalism in birds. Pp. 277–298 in M. A. Elgar & B. J. Crespi, eds. *Cannibalism: ecology and evolution among diverse taxa.* New York: Oxford University Press.

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Nesting Fork-tailed Swifts *Apus pacificus* in north-eastern Vietnam

VLADIMIR DINETS

The breeding distribution of many bird species in Tonkin, northern Vietnam, is still poorly known (Pilgrim *et al.* 2009). That of Fork-tailed Swift *Apus pacificus* is no exception. In the most up-to-date overview of the region's avifauna, Robson (2011) lists this species as resident in West, but not East, Tonkin, which suggests a gap of at least 600 km between breeding sites in north-western Vietnam and those in southern China. Observations reported here show that such a gap does not exist.

On 17 June 2011 a colony of Fork-tailed Swifts was found on a small limestone islet (20°45'N 107°03'E) close to Cat Ba Island in Ha Long Bay, north-eastern Vietnam. The swifts were nesting in a deep crevice in a vertical rockface rising from the sea, approximately 25 m above the high-tide mark. The nests were not visible, but swifts (up to four at a time) were repeatedly observed entering and leaving the crevice. House Swifts *A. affinis* were nesting on a more exposed rock surface about 30 m from the crevice in larger numbers (at least ten active nests), providing a good opportunity for comparing the birds side-by-side. The Fork-tailed Swifts were larger, with longer, narrower wings, and narrower white rump-bands. Their calls also differed obviously from those of the House Swifts, being